CLAIMS

1. A self-cleaning colloidal slurry composition for superfinishing a surface of a substrate, the self-cleaning colloidal slurry composition comprising:

a carrying fluid;

colloidal particles;

etchant for etching the substrate;

a surfactant adsorbed and/or precipitated onto a surface of at least one of the substrate and the colloidal particles, the surfactant having a hydrophobic section that forms a steric hindrance barrier between the substrate and the colloidal particles.

2. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the substrate is selected from a group consisting of a glass disk substrate, a ceramic disk substrate, and a glass-ceramic disk substrate for use in a data storage device.

3. The self-cleaning colloidal slurry composition as recited in claim 2, wherein the substrate is a silicate-based glass disk substrate.

4. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the colloidal particles include colloidal silica particles, the surfactant is a nonionic surfactant and/or cationic, and the self-cleaning colloidal slurry composition has a pH of approximately 0 to 4.

5. The self-cleaning colloidal slurry composition as recited in claim 4, wherein the self-cleaning colloidal slurry composition has a pH of approximately 0.8 to 3.0.

6. The self-cleaning colloidal slurry composition as recited in claim 5, wherein the self-cleaning colloidal slurry composition has a pH of approximately 1.0 to 2.0.

7. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the colloidal particles include colloidal silica particles, the surfactant is a cationic quaternary amine surfactant, and the self-cleaning colloidal slurry composition has a pH of approximately 7 to 12.

8. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the colloidal particles include colloidal alumina or colloidal silica coated with alumina, and the self-cleaning colloidal slurry composition has a pH of approximately 3.5 to 10.5.

9. The self-cleaning colloidal slurry composition as recited in claim 4, wherein the colloidal silica particles have a nominal size of approximately 2 - 200 nm.

10. The self-cleaning colloidal slurry composition as recited in claim 6, wherein the colloidal silica particles include colloidal silica spheres having a nominal size of approximately 7 nm.

11. The self-cleaning colloidal slurry composition as recited in claim 3, wherein the etchant is a metal etchant selected from a group consisting of Ce, Zr, Ti, Fe, Sn, Al, Cr, Ni, Mn and Zn, and combinations thereof, and wherein the metal etchant is present in solution and/or as a colloid and/or as an ion on the colloidal particles.

12. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the etchant is an acid or base solution.

13. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the surfactant is a nonionic and/or cationic surfactant selected from a group consisting of oxygen containing compounds and nitrogen containing compounds, and combinations thereof.

14. The self-cleaning colloidal slurry composition as recited in claim 13, wherein the nonionic surfactant is an oxygen containing compound with moieties of ethylene oxide and/or polyvinyl alcohol.

15. The self-cleaning colloidal slurry composition as recited in claim 13, wherein the nonionic and/or cationic surfactant is a nitrogen containing compound selected from a group consisting of alkaloids and amines, and combinations thereof.

16. The self-cleaning colloidal slurry composition as recited in claim 13, wherein the nonionic and/or cationic surfactant is a polydentate adsorption surfactant.

17. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the surfactant is a cationic surfactant.

18. The self-cleaning colloidal slurry composition as recited in claim 1, wherein the surfactant is selected from a group consisting of anionic surfactants and quaternary amine surfactants.

19. A process for superfinishing a surface of a substrate, the process comprising the steps of:

applying a self-cleaning colloidal slurry to the surface of the substrate, the self-cleaning colloidal slurry comprising

a carrying fluid,

colloidal particles,

etchant for etching the substrate,

a surfactant adsorbed and/or precipitated onto a surface of at least one of the substrate and the colloidal particles, the surfactant having a hydrophobic section that forms a steric hindrance barrier between the substrate and the colloidal particles;

mechanically rubbing the surface of the substrate with a pad while contacting the surface of the substrate with the self-cleaning colloidal slurry.

20. The process as recited in claim 19, wherein the substrate is selected from a group consisting of a glass disk substrate, a ceramic disk substrate, and a glass-ceramic disk substrate for use in a data storage device.

21. The process as recited in claim 20, wherein the substrate is a silicate-based glass disk substrate.

22. The process as recited in claim 19, wherein the surfactant is a nonionic and/or cationic surfactant selected from a group consisting of oxygen containing compounds and nitrogen containing compounds, and combinations thereof.

23. The process as recited in claim 22, wherein the nonionic surfactant is an oxygen containing compound with moieties of ethylene oxide and/or polyvinyl alcohol.

24. The process as recited in claim 22, wherein the nonionic and/or cationic surfactant is a nitrogen containing compound selected from a group consisting of alkaloids and amines, and combinations thereof.

25. The process as recited in claim 22, wherein the nonionic and/or cationic surfactant is a polydentate adsorption surfactant.

26. The process as recited in claim 19, wherein the surfactant is a cationic surfactant.

27. The process as recited in claim 19, wherein the surfactant is selected from a group consisting of anionic surfactants and quaternary amine surfactants.

28. The process as recited in claim 19, further comprising the step of cleaning the surface of the substrate using standard soap solutions, wherein the cleaning step is performed after the step of mechanically rubbing the surface of the substrate with the pad while contacting the surface of the substrate with the self-cleaning colloidal slurry, and wherein the cleaning step removes substantially all of the remaining contamination from the surface of the substrate, the remaining contamination being at least partially due to the colloidal particles in the self-cleaning colloidal slurry.

29. A disk substrate for use in a data storage device, the disk substrate comprising:

substrate material having a surface roughness of less than 2 Å; the substrate material being selected from a group consisting of glass, ceramic, and glass-ceramic; and the substrate material having essentially no surface contamination even though the surface of the substrate material was not subjected to a cleaning process that utilized etching or micropolishing or cleaning polish etch, or a combination thereof, to remove contaminants therefrom.

30. The disk substrate as recited in claim 29, wherein the substrate material is a silicate-based glass.

31. A data storage disk for use in a data storage device, comprising:

a disk substrate comprising a substrate material having a surface roughness of less than 2 Å; the substrate material being selected from a group consisting of glass, ceramic, and glass-ceramic; and the substrate material having essentially no surface contamination even though the surface of the substrate material was not subjected to a cleaning process that utilized etching or micropolishing or cleaning polish etch, or a combination thereof, to remove contaminants therefrom;

a recording layer applied over at least one surface of the disk substrate.

32. The data storage disk as recited in claim 31, wherein the substrate material is a silicate-based glass.

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33. A data storage device, comprising:

a data storage disk comprising a disk substrate, the disk substrate comprising a substrate material having a surface roughness of less than 2 Å; the substrate material being selected from a group consisting of glass, ceramic, and glass-ceramic; the data storage disk further comprising a recording layer applied over at least one surface of the disk substrate; and the substrate material having essentially no surface contamination even though surface of the substrate material was not subjected to a cleaning process that utilized etching or micropolishing or cleaning polish etch, or a combination thereof, to remove contaminants therefrom;

a transducer;

an actuator provided to position the transducer relative to the data storage disk;

a motor provided to rotate the storage disk relative to the transducer.

34. The data storage device as recited in claim 33, wherein the substrate material is a silicate-based glass.

35. A self-cleaning colloidal slurry composition for finishing a surface of a substrate, the self-cleaning colloidal slurry composition comprising:

a carrying fluid;

colloidal particles;

etchant for etching the substrate;

a surfactant adsorbed and/or precipitated onto a surface of at least one of the substrate and the colloidal particles, the surfactant having a hydrophobic section that forms a steric hindrance barrier between the substrate and the colloidal particles.

36. The self-cleaning colloidal slurry composition as recited in claim 35, wherein the colloidal particles have a nominal size of approximately 70 - 200 nm to provide a textured surface on the substrate.

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37. A process for finishing a surface of a substrate, the process comprising the steps of:

applying a self-cleaning colloidal slurry to the surface of the substrate, the self-cleaning colloidal slurry comprising

a carrying fluid,

colloidal particles,

etchant for etching the substrate,

a surfactant adsorbed and/or precipitated onto a surface of at least one of the substrate and the colloidal particles, the surfactant having a hydrophobic section that forms a steric hindrance barrier between the substrate and the colloidal particles;

mechanically rubbing the surface of the substrate with a pad while contacting the surface of the substrate with the self-cleaning colloidal slurry.

38. The process as recited in claim 37, further comprising the step of cleaning the surface of the substrate using standard soap solutions, wherein the cleaning step is performed after the step of mechanically rubbing the surface of the substrate with the pad while contacting the surface of the substrate with the self-cleaning colloidal slurry, and wherein the cleaning step removes substantially all of the remaining contamination from the surface of the substrate, the remaining contamination being at least partially due to the colloidal particles in the self-cleaning colloidal slurry.

39. The process as recited in claim 37, wherein the step of mechanically rubbing the surface of the substrate with a pad while contacting the surface of the substrate with the self-cleaning colloidal slurry provides a textured surface on the substrate.